

CBRN PAPR Laboratory Respirator Protection Level (LRPL)

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NIOSH/NPPTL Public Meeting
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CBRN PAPR Laboratory Respirator Protection Level (LRPL)

- **Description- Fit-factor corn oil aerosol test**
- **Purpose- Establishes a benchmark level of protection under laboratory conditions**
- **Not intended as an indication of protection in an actual response scenario**

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Challenge Aerosol Criteria

- **20 – 40 mg/m³ Corn Oil aerosol**
- **0.4 – 0.6 µm Mass Median Aerodynamic Diameter**

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Pass/Fail Level

- **LRPL $\geq 10,000$ for $\geq 95\%$ of test trials**
- **Evaluated over 11 test exercises**
- **Tested with PAPR blower operating**

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Laboratory Respirator Protection Level (LRPL)

Subject Exercises

- | | |
|---|--|
| 1) Normal Breathing | + 6) Sight a Mock Rifle |
| 2) Deep Breathing | 7) Reach for the Floor and Ceiling |
| 3) Turn Head Side to Side | + 8) On Hands and Knees, Look Side to Side |
| 4) Move Head Up and Down | 9) Facial Grimace |
| 5) Recite the Rainbow Reading Passage or equivalent | + 10) Climb Stairs at a Regular Pace |
| | 11) Normal Breathing |
| | + emergency response exercises |

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Human Subject Anthropometric Parameters (applicable based on PAPR design)

- **Neck Circumference**
 - (example: for tight-fitting neck dams)
- **Head Circumference**
 - (example: for hooded models, 'Large' criteria)
- **Face Length**
 - (example: for tight fitting face-masks)
- **Face Width**
 - (example: for tight fitting face-masks)

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Development of NIOSH LRPL Panel

- **Anthropometric ranges established as part of CBRN Escape Respirator standard**
- **Ranges established through review of population data of head, neck, face length, and width sizes**

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Development of NIOSH LRPL Panel

- **‘Face Length’ and ‘Face Width’ Ranges**
 - Adapted from Los Alamos panel report
*Selection of Respirator Test Panels
Representative of U.S. Adult Facial Sizes.*
LA5488. 1974

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Development of NIOSH LRPL Panel

- Neck and Head circumference ranges are based on latest NIOSH research data by Zhuang, et. al.
- NIOSH survey conducted for purposes of establishing updated panels for NIOSH respirator certification and international standards
- Subjects recruited from industries nationwide (manufacturing, construction, health care, law enforcement, and firefighting)

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Development of NIOSH LRPL Panel

- **NIOSH survey: Total Subjects = 3,998**
- **2,243 subjects (1,140 male and 1,103 female) had complete measurements for:**
 - **Face Length and Width**
 - **Head Circumference**
 - **Neck Circumference**

CBRN PAPR LRPL Test Panel

	Small	Medium	Large
	Cell A	Cell D	Cell G
Face Length and Face Width	Use LANL boxes 1, 2, 3, 4 (2 or 3 subjects each box, 2 trials per subject)	Use LANL boxes 3, 4, 5, 6, 7, 8; panel size 17 (2 or 3 each box, 2 trials per subject)	Use LANL boxes 7, 8, 9, 10; panel size 11 (2 or 3 each box, 2 trials per subject)
	Subjects= 10	Subjects= 17	Subjects= 11
	Trials= 20	Trials= 34	Trials= 22
Head Circumference	Cell B	Cell E	Cell H
	N / A	N / A	570-603 mm
	Subjects= 0	Subjects= 0	Subjects= 10
	Trials= 0	Trials= 0	Trials= 20
Neck Circumference	Cell C	Cell F	Cell I
	306-378 mm	355-403 mm	378-451 mm
	Subjects= 10	Subjects= 10	Subjects= 10
	Trials= 20	Trials= 20	Trials= 20

3 Size Model —————> **Test Each Column Corresponding with Unique Size**

‘One-Size-Fits-All’ —————> **Test All Size Columns**

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Overlapping Size Ranges for Neck Circumference Using NIOSH Population Data

Expanded Neck circumference ranges increase the chance a subject will fulfill multiple ranges of anthropometric criteria.



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Practical Performance

- **Evaluated during Laboratory Respirator Protection Level testing**
- **Evaluates that the power switch is not accidentally switched off**
- **Evaluates that hoses and electrical wires do not tangle and cause the respirator facepiece or hood to move to an improper position, such as being removed**
- **Evaluates wear in accordance with manufacturer's user instructions**

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Summary- Test Considerations

- **Possibility of facepiece particle concentration being affected by particles generated by PAPR blower lubricants**

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Summary- Timeline

- **Develop Standard Test Procedures
(May-June 04)**
- **Perform Verification Testing
(August-September 04)**